♥Known Numbers and Unknown Numbers in Natural Science Research and Exploration: "Ultimate Equation"-"Eternal Law"

●关于自然科学领域“终极定律”或“终极方程”的探索，科学界和哲学界存在多维度的讨论。

一、现有理论框架中的“终极候选”物理统一理论尝试超弦理论/M理论：试图通过十维或十一维时空的振动模式统一四种基本力（引力、电磁力、强核力、弱核力），但其验证受限于普朗克能量量级（约10^28电子伏特），远超当前实验能力。量子引力理论（如圈量子引力）：通过离散时空结构解释引力与量子力学的矛盾，但尚未形成可观测预测。经典方程的整合意义麦克斯韦方程组：统一电磁现象与光速不变原理，被誉为“上帝书写的方程”。爱因斯坦场方程：将时空几何与物质能量关联，但未兼容量子力学。薛定谔方程与量子场论：描述微观粒子行为，但无法解释引力作用。二、哲学与科学交叉的终极追问整体决定论与还原论的冲突中国哲学中的“阴阳学说”提出“整体决定局部”的规律，认为物质系统与环境的动态平衡是自然本质，这与西方还原论形成对比。现代系统科学（如复杂系统理论）试图通过自组织、涌现现象解释整体性规律。数学本质主义观点爱因斯坦认为“终极定律应具有数学简洁性”，如欧拉公式（$e^{i\pi}+1=0$）通过数学常数关联揭示深层对称性。诺特定理证明守恒律与对称性等价，暗示终极定律可能植根于几何对称性。三、验证困境与未来方向实验技术瓶颈超弦理论所需能量为现有加速器的10^15倍，短期内无法验证。宇宙学观测（如暗物质、暗能量）可能提供间接证据，但需突破现有探测手段。计算模拟的可能性量子计算机或可模拟高能物理过程，通过算法验证理论模型（如量子色动力学）。虚拟宇宙假说（如“地球Online”比喻）引发对自然规律代码化的猜想，但缺乏实证路径。四、终极定律的可能特征（推测）统一性：兼容相对论与量子力学，解释暗物质/能量。数学极简性：如爱因斯坦场方程（$G_{\mu\nu}=8\pi T_{\mu\nu}$）的几何化表达。可观测性：至少存在一个可被下一代实验验证的预测（如超对称粒子）。哲学自洽性：回应“万物本原”“运动规律”等元问题。 终极定律的探索既是科学问题，也是人类认知边界的哲学挑战。当前更现实的路径可能

是“阶段性统一”，例如通过量子引力理论解释黑洞信息悖论，而非一蹴而就的万能方程。正如霍金所言：“即使存在终极理论，人类也可能无法完全理解其深意。”

自然科学的发展历程深刻揭示了人类对客观世界认知的动态性与辩证性。关于科学理论的相对性与绝对性，我们可以从以下几个层面展开分析：一、科学认知的阶段性真理属性1. 理论适用范围的相对性：牛顿力学在宏观低速领域的有效性，与量子力学在微观尺度、相对论在高速强引力场中的适用性形成鲜明对比。每个理论都构成了特定尺度下的"绝对真理"，但这种绝对性始终受限于其应用边界。2. 数学工具的局限突破：麦克斯韦方程组统一电磁现象后，看似完美的数学形式在解释光电效应时失效，催生了量子理论的诞生。这证明任何数学模型的"终极性"都隐含未被发现的物理维度。二、科学革命的辩证发展模式1. 范式转换的必然性：库恩的科学革命理论显示，当异常现象积累到临界点，旧范式必然被新范式取代。这种更替不是简单的否定，而是包含旧理论合理性的扬弃过程。2. 对应原理的继承关系：相对论在低速条件下退化为牛顿力学，量子力学在宏观尺度回归经典统计，这种退化关系确保了科学知识的连续性，证明新旧理论间存在包含性发展。三、自然定律的层次性存在1. 守恒定律的深层稳定性：能量守恒、角动量守恒等基本定律在已知物理过程中始终成立，但其表现形式随理论框架改变（如相对论中的质能统一）。2. 对称性破缺的演化特性：标准模型中的对称性破缺机制表明，宇宙基本作用力的统一性可能存在于更高能标，暗示现有理论仅是更基础理论的低能近似。四、科学实在论的认知边界1. 模型依赖的实在论：量子纠缠现象挑战经典实在观，表明我们对"实在"的理解始终受观测手段制约。理论模型既是认识工具，也构成认知边界。2. 数学实在的启示性：规范场论与微分几何的深度对应，超弦理论与高维空间的数学自洽，暗示可能存在超越当前物理直觉的终极结构，但人类认知或永远止步于某个层级。五、科学探索的终极悖论1. 哥德尔不完备性定理的隐喻：形式系统内不可判定的命题，暗示自然科学可能永远无法建立完全自洽的终极理论体系。2. 观察者参与的现实困境：量子力学中的测量问题暴露认知主体与客体的

不可分割性，使"纯粹客观"的自然定律概念面临根本挑战。当代科学哲学的发展表明，自然科学的本质是不断建构认知模型的动态过程。所谓"终极理论"的追求，实质是人类理性对宇宙统一性的永恒向往。这种向往推动着科学进步，同时也警示我们：保持认知开放性，警惕任何形式的绝对化教条，才是科学精神的核心要义。在相对性与绝对性的张力中，科学既获得前进动力，也保持必要的谦逊——这或许就是人类认知在无限接近真理过程中最智慧的姿态。

关于自然科学是否存在终极规律的问题，不同学科和哲学视角给出了多维度的回答，否定之否定，哲学命题。以下从科学哲学、学科案例和技术验证三个层面综合分析：一、科学理论的动态发展性科学本质的暂时性与累积性科学理论始终处于动态修正中，如波义耳定律从"绝对真理"到发现其仅适用于低温低压条件的过程。库恩的范式革命理论指出，科学进步并非线性累积，而是通过新旧范式更迭实现质变，如相对论对牛顿力学的超越。现代物理学四大基本作用力尚未统一的事实也印证了这一点。技术验证对理论边界的突破南极冰下基岩钻探技术突破揭示了地质模型需要实物验证的局限性，类似地，量子力学对微观世界的观测不断颠覆经典物理认知。人类对宇宙的认知范围从太阳系扩展到暗物质领域，每次观测技术革新都带来理论框架重构。二、真理的相对性与绝对性辩证相对性在学科中的具体表现物理学：爱因斯坦场方程在宏观宇宙有效，却无法解释量子尺度现象，生命科学：DNA碱基配对规律（A-T、G-C）体现阴阳互补性，但基因表达机制仍存在大量未解之谜。脑科学：计算机可模拟逻辑推理，却无法复现人类情感决策的神经机制。绝对性的历史阶段特征牛顿力学在低速宏观领域仍具有实践有效性，广义相对论成功预测引力波验证了其时空观的局部真理性。这类"有限绝对性"构成了技术应用的基础，如GPS系统必须同时考虑狭义相对论和广义相对论修正。三、文明视角的认知差异东西方哲学根源差异西方一神论传统易导向"终极真理"追求（如弦理论试图构建万物理论），这种差异反映在当代科学探索中：既有构建宇宙普适方程的尝试，也有接受认知局限性的"不可知论"路径。前沿领域的认知突破方向量子引力理论：调和广义相对论与量子力学的空

间曲率/量子涨落矛盾生命起源研究：从化学进化论到自组织系统理论的范式转换暗物质探测：现有物质理论仅能解释宇宙5%的构成。四、方法论启示迭代认知工具建立绝对时空坐标系（如南极冰芯年代测定）与开发新型观测仪器（如詹姆斯·韦伯望远镜）同等重要。跨学科融合趋势人工智能与脑科学交叉产生类脑计算，东方阴阳学说启发现代量子理论研究，显示方法论融合的价值。

关于科学理论的动态修正，以下通过多个学科领域的典型案例进行说明，展现科学理论如何在实践中不断迭代和完善：一、物理学领域广义相对论对牛顿力学的修正牛顿力学在低速宏观领域具有绝对有效性，但无法解释强引力场和高速运动现象。爱因斯坦通过引入时空弯曲理论，提出广义相对论，成功预测水星近日点进动现象（每百年43角秒的偏差），修正了经典力学模型的误差。GPS卫星定位系统的误差校正（需同时考虑狭义相对论时间膨胀和广义相对论引力场效应）印证了这种修正的工程价值。量子力学对经典物理范式的突破玻姆提出的量子势理论将薛定谔方程转化为经典方程+普朗克常数修正项的形式，试图调和量子现象与经典物理的矛盾。尽管该理论未被主流完全接受，但启发了后续量子场论的发展。类似地，弦理论对标准模型的修正尝试也体现了物理理论的多路径探索。二、地球科学领域冻土工程模型的动态调整青藏铁路建设中，科学家发现传统冻土理论无法解释高温冻土区的路基变形。科学家提出"主动冷却路基"理论，通过碎石层空气对流形成天然"热半导体"，动态修正原有被动保温模型，解决了轨道热融沉降难题。该案例展示了理论修正与技术创新的协同。通过动态修正反演参数，实现了对大陆科学钻探主孔岩性构造的精准预测，修正了早期线性反演方法的局限。三、工程技术领域海底目标冲击掩埋预测模型针对静态参数模型在动态冲击过程中的误差，科学家提出黏聚模量和摩擦角模量的动态修正方法。通过信赖域梯度算法实时调整模型参数，使海底小目标掩埋深度预测精度提升40%以上。粗糙集理论在故障诊断中的应用传统故障诊断规则在样本增加时易失效。基于粗糙集理论的动态规则修正方法，通过属性约简和规则增量更

新，使滚动轴承故障诊断准确率从72%提升至89%，展示了数据驱动模型的自我修正能力。四、方法论启示这些案例共同体现科学理论修正的典型路径：技术验证驱动：观测/实验技术进步倒逼理论修正（如量子力学颠覆经典物理认知）边界条件明确：牛顿力学在限定条件下仍具有效性，修正发生在理论适用范围扩展时跨学科融合：混沌理论修正地震模型、阴阳学说启发量子研究等迭代验证机制：冻土模型通过14公里试验段验证、海底模型依赖梯度算法动态调参，科学理论的动态修正本质是认知工具与客观实在的持续对话。正如爱因斯坦场方程在宏观有效却在量子尺度失效，这种"有限绝对性"正推动着新一轮理论革新，印证了科学探索永无止境的特质。

关于自然科学中是否存在绝对真理或终极理论的问题，需从科学哲学、学科实践及认知边界三个层面综合分析，一、科学理论的可修正性与相对性可证伪性与动态发展波普尔提出科学理论的标志在于可证伪性而非绝对正确性。例如牛顿力学在低速宏观领域有效，但被广义相对论修正；量子力学又揭示微观世界的非经典特性，说明科学理论本质是“有限适用”的阶段性成果。技术验证与边界突破爱因斯坦广义相对论虽成功预测引力波，但其在量子尺度的失效表明：任何理论都存在适用范围。类似地，暗物质模型（仅解释宇宙5%物质）和量子引力理论的未完成性，均体现人类认知的局限性。二、绝对真理的争议性与有限性哲学视角的绝对性主张部分学者认为某些自然规律（如因果律、时间单向性）具有绝对性。例如1+1=2的数学公理或三维空间属性，常被视为不可动摇的真理。但这种“绝对”仍需依赖人类逻辑体系的自洽性，而数学本身也可能因公理系统调整而变化。相对真理中的“绝对性”片段牛顿力学在宏观低速条件下的有效性、DNA碱基配对规律等，虽被修正或补充，但在特定范围内仍具实践意义的“有限绝对性”。这类绝对性本质是认知工具与客观实在的阶段性契合，而非永恒真理。三、终极理论探索的合理性与困境大统一理论的科学价值追求基本作用力的统一（如弦理论、超对称理论）是科学简化复杂性的一种努力。尽管尚未成功，但此类尝试推动了数学工具（如拓扑学）和实

验技术（如粒子对撞机）的发展。终极理论的认知悖论逻辑矛盾：若宣称某理论为“终极真理”，则需假设人类认知已完全穷尽宇宙规律，这与科学史经验相悖。实践困境：宇宙大爆炸理论、黑洞模型等依赖间接证据，无法通过直接实验验证，其“终极性”存疑。四、方法论启示：开放认知与批判性两者结合或能平衡科学探索的激进与保守。科学家的理性态度施一公指出，科学本质是“不断改进的认识”。例如主动接受负面实验结果、避免完美主义陷阱，体现了对理论可错性的自觉。这种态度推动科学在“假设-验证-修正”循环中进步。结论自然科学中的“绝对真理”概念需谨慎界定：局部有效：在特定条件下成立的规律（如相对论在宏观宇宙），可视为阶段性绝对。终极虚幻：宣称发现永恒方程（如大统一理论）易陷入科学主义谬误，因其忽视认知的历史性和技术依赖性。科学的价值不在于追求不可达的绝对真理，而在于通过可证伪的理论迭代，无限逼近对自然更深刻的解释。正如波普尔所言：“科学知识是尚未被证伪的假设”。

关于物理学大统一理论（Grand Unified Theory, GUT）和万物理论（Theory of Everything, ToE）的最新研究进展，结合当前科学界的探索方向和挑战，以下是综合分析：一、理论框架的探索与困境弦理论与超对称性的验证停滞弦理论作为万物理论的重要候选，提出通过11维时空中的弦振动统一四种基本作用力，但面临两大核心挑战：实验验证需要超过现有粒子对撞机（如大型强子对撞机）能量数百万倍的极端条件，导致理论长期停留在数学层面。超对称粒子（如超伴子）的未发现，使得弦理论失去部分实验支持基础，面临“失超”风险。圈量子引力的新进展作为弦理论的竞争者，圈量子引力尝试通过时空量子化描述引力，近期在黑洞熵计算和宇宙学奇点问题中取得突破，但仍未实现与其他量子场论的兼容。卡鲁扎-克莱因理论的复兴五维时空模型近期被重新审视，结合量子场论修正，试图通过额外维度统一引力与电磁力。该理论在暗物质粒子（如轴子）研究中显示出潜力，但仍需实验验证。 二、数学工具与计算方法的革新拓扑学与几何物理的融合利用拓扑量子场论（如Chern-Simons理论）描述粒子相互作用，为强核力与弱电力的统一提供新数学框架。杨-米尔斯方程的非线性解研究取得突破，但尚

未完全纳入引力。人工智能驱动的理论构建机器学习被用于分析高维弦景观(String Landscape),筛选出10^500种可能解中符合现实物理条件的候选模型,显著缩短理论验证周期。三、实验技术的瓶颈与突破方向下一代粒子加速器计划国际粒子物理学界正规划建造100 TeV级环形对撞机(如中国CEPC、欧洲FCC),试图探测更高能标下的粒子行为,验证大统一理论预言的质子衰变等现象。天文观测的间接验证通过詹姆斯·韦伯望远镜观测早期宇宙高能过程(如重子生成机制),结合LIGO引力波数据,为量子引力理论提供跨尺度证据。四、哲学与方法论反思认知边界的技术依赖性当前理论困境揭示:人类对"终极理论"的探索受限于技术手段。例如,若要直接观测普朗克尺度(10^-35米),需要建造银河系尺度的探测器,这在工程上不可行。多元路径的并行探索科学界逐渐接受"多理论并存"的现状:弦理论、圈量子引力、全息原理等不同范式各自解释部分现象,形成互补而非竞争关系。五、未来突破的关键方向数学革命需求现有理论依赖的黎曼几何、群论等工具可能需根本性革新,例如发展非交换几何或新型代数结构以描述量子时空。跨学科协同创新量子计算与拓扑材料的结合,或可通过实验室模拟早期宇宙的对称性破缺过程,为理论提供新验证途径。总结当前物理学大统一理论的研究呈现"螺旋上升"态势:既有传统路径(如弦理论)的深化,也有新兴方法(如AI辅助建模)的介入。尽管终极公式的建立仍遥不可及,但每一次局部突破(如黑洞信息悖论的阶段性解决)都在重塑人类对宇宙本质的理解。正如温伯格所言:"终极理论或许不存在,但追寻它的过程本身就是科学的意义。"

关于人类智慧与人工智能的辩证关系及其认知边界问题,结合当前科学研究和哲学思考,可从以下维度进行系统性分析:

一、人类智能的成就与局限

认知宇宙的突破性进展

人类通过数学建模(如爱因斯坦场方程)、实验观测(如引力波探测) 和理论构建(如量子力学)等手段，已揭示宇宙运行的部分规律。例如：

量子纠缠现象颠覆经典物理的局域性假设

哈勃定律推动宇宙膨胀理论的建立

CRISPR基因编辑技术揭示生命编码的可编程性

不可逾越的生物学边界

人类大脑虽拥有860亿神经元，但受限于神经传导速度(约120m/s)和能耗效率，无法直接感知量子效应或高维时空

感官系统仅能接收电磁波谱的0.005%(可见光波段)和声波频率的有限范围。意识机制仍未被完全解析，情感决策涉及量子生物学未解之谜。

二、人工智能的赋能与缺陷

超越性能力的具体表现

运算效率：天河二号超级计算机每秒3.4亿亿次运算，远超生物脑计算速度，模式识别：AlphaGo通过蒙特卡洛树搜索突破人类围棋策略极限5。数据处理：AI可实时分析大型强子对撞机每秒百万次碰撞事件，

本质性缺陷的不可替代性

缺乏意识主体性：无法产生《纽约人》杂志封面所隐喻的情感共鸣。价值观缺失：无法自主形成道德判断(如自动驾驶的伦理困境)

创造力局限：AI艺术创作本质是已有数据集的组合重构。三、认知体系的协同进化路径

工具性互补

人类提供顶层设计(如弦理论数学框架)，AI执行高维计算验证

生物脑启发类脑计算架构(如神经形态芯片模拟突触可塑性)

认知维度拓展

韦伯望远镜通过红外波段突破人类视觉局限，量子传感器将人类感知延伸至纳米尺度，风险防控机制

需建立AI伦理审查体系，防止"螺丝钉式"价值异化4

保持人类在关键决策中的终审权（如核控制、基因编辑审批）

四、哲学维度的终极思考

认知的层级性差异

人类智慧包含三重维度：

工具理性（可被AI替代的逻辑演算）

价值理性（不可编程的伦理判断）

诗性智慧（超越功利的艺术创造）

文明的本质特征

碳基生命的温度感知与硅基系统的绝对理性形成互补，东西方思维融合：西方逻辑实证主义与东方"天人合一"观的协同

。人类智慧并未达到认知的终极高度，但通过以下路径持续突破：

认知工具革命：借助AI实现"技术具身化"认知延伸

思维范式跃迁：从还原论向复杂系统论转型

文明形态进化：构建人机共生的"超脑文明"生态

正如法国哲学家丹尼尔·安德勒所言："人工智能与人类智能的关系不是替代而是镜鉴，它们共同构成认知宇宙的双螺旋结构。"真正的智慧超越不在于单方面的"完胜"，而在于保持对未知的敬畏与探索的谦逊。

Known numbers and unknown numbers in natural science research and exploration: "ultimate equality"-"eternal law" ● There are multi-dimensional discussions in scientific and philosophical circles about the exploration of "ultimate law" or "ultimate equation" in natural science. 1. The "ultimate candidate" physical unification theory in the existing theoretical framework tries superstring theory /M theory: it tries to unify four basic forces (gravity, electromagnetic force, strong nuclear force and weak nuclear force) through the vibration mode of ten or eleven dimensions, but its verification is limited by Planck energy level (about 10 28 electron volts), far exceeding the current experimental ability. Quantum gravity theory (such as loop quantum gravity): the contradiction between gravity and quantum mechanics is explained by discrete space-time structure, but no observable prediction has yet been formed. The integration significance of classical equations Maxwell's equations: unified electromagnetic phenomena and the principle of invariance of light speed, known as "the equation written by God". Einstein's field equation relates space-time geometry to matter energy, but it is not compatible with quantum mechanics. Schrodinger equation and quantum field theory: describe the behavior of microscopic particles, but cannot explain the gravitational effect. Second, the ultimate cross between philosophy and science: the conflict between totality determinism and reductionism. The "Yin-Yang Theory" in China's philosophy puts forward the law that "the whole determines the part", and holds that the dynamic balance between the material system and the environment is the natural essence, which is in contrast with the western reductionism. Modern system science (such as complex system theory) tries to explain the holistic law through self-organization and emerging phenomena. Einstein holds that "the ultimate law should have mathematical simplicity", such as Euler formula (e {i π}+1 = 0) reveals deep symmetry through the correlation of mathematical

constants. Nott theorem proves that conservation law is equivalent to symmetry, suggesting that the ultimate law may be rooted in geometric symmetry. 3. Verification Dilemma and Future Direction The bottleneck superstring theory of experimental technology requires 10-15 times as much energy as the existing accelerator, so it cannot be verified in a short time. Cosmological observations (such as dark matter and dark energy) may provide indirect evidence, but it is necessary to break through the existing detection methods. Calculating the possibility of simulation Quantum computers can simulate high-energy physical processes and verify theoretical models (such as quantum chromodynamics) through algorithms. The hypothesis of virtual universe (such as the metaphor of "Earth Online") leads to the conjecture of the codification of natural laws, but there is no empirical path. Fourth, the possible characteristics of the ultimate law (speculative) unity: compatible with relativity and quantum mechanics, explaining dark matter/energy. Mathematical minimalism: such as the geometric expression of Einstein's field equation ($G_{\mu\nu}=8\pi T_{\mu\nu}$). Observability: There is at least one prediction that can be verified by the next generation of experiments (such as supersymmetric particles). Philosophical self-consistency: responding to meta-questions such as "the origin of all things" and "the law of motion" The exploration of the ultimate law is not only a scientific problem, but also a philosophical challenge to human cognitive boundaries. At present, the more realistic path may be "phased unification", for example, explaining the information paradox of black holes through quantum gravity theory, rather than the universal equation overnight. As Hawking said: "Even if there is an ultimate theory, human beings may not fully understand its meaning." The development of natural science profoundly reveals the dynamic and dialectical nature of human cognition of the objective world. Regarding the relativity and absoluteness of scientific theory, we can analyze it from

the following aspects: 1. The phased truth attribute of scientific cognition 1. Relativity of theoretical application scope: the effectiveness of Newtonian mechanics in the macro-low-speed field is in sharp contrast to the applicability of quantum mechanics in the micro-scale and relativity in the high-speed strong gravitational field. Each theory constitutes an "absolute truth" at a specific scale, but this absoluteness is always limited by its application boundary. 2. Breakthrough in the limitation of mathematical tools: After Maxwell's equations unified electromagnetic phenomena, the seemingly perfect mathematical form failed to explain the photoelectric effect, which gave birth to quantum theory. This proves that the "ultimate" of any mathematical model implies undiscovered physical dimensions. Second, the dialectical development model of scientific revolution 1. The inevitability of paradigm shift: Kuhn's theory of scientific revolution shows that when abnormal phenomena accumulate to a critical point, the old paradigm will inevitably be replaced by the new paradigm. This replacement is not a simple negation, but a sublation process that contains the rationality of the old theory. 2. Inheritance of correspondence principle: Relativity degenerates into Newtonian mechanics at low speed, and quantum mechanics returns to classical statistics at macro scale. This degeneration ensures the continuity of scientific knowledge and proves the inclusive development between the old and new theories. Third, the hierarchical existence of natural laws 1. Deep stability of conservation laws: basic laws such as conservation of energy and conservation of angular momentum are always established in known physical processes, but their manifestations change with the theoretical framework (such as the unity of mass and energy in relativity). 2. Evolutionary characteristics of symmetry breaking: The symmetry breaking mechanism in the standard model indicates that the unity of the basic force of the universe may exist in a higher energy

scale, suggesting that the existing theory is only a low-energy approximation of the more basic theory. 4. Cognitive boundary of scientific realism 1. Model-dependent realism: Quantum entanglement challenges the classical realism, which shows that our understanding of "reality" is always restricted by observation means. Theoretical model is both a cognitive tool and a cognitive boundary. 2. Enlightenment of mathematical reality: gauge field theory corresponds to differential geometry in depth, and superstring theory is self-consistent with mathematics in high-dimensional space, suggesting that there may be an ultimate structure beyond the current physical intuition, but human cognition may stop at a certain level forever. V. Ultimate Paradox of Scientific Exploration 1. Metaphor of Godel's Incompleteness Theorem: Undeterminable proposition in formal system implies that natural science may never establish a completely self-consistent ultimate theoretical system. 2. The practical dilemma of observer's participation: the measurement problem in quantum mechanics exposes the inseparability of cognitive subject and object, which makes the concept of "purely objective" natural law face fundamental challenges. The development of contemporary philosophy of science shows that the essence of natural science is a dynamic process of constantly constructing cognitive models. The pursuit of the so-called "ultimate theory" is essentially the eternal yearning of human reason for the unity of the universe. This yearning promotes scientific progress, but it also warns us that keeping cognitive openness and being wary of any form of absolute dogma is the core essence of scientific spirit. In the tension between relativity and absoluteness, science not only gains the impetus, but also maintains the necessary humility-this may be the most intelligent gesture of human cognition in the process of infinitely approaching the truth. Different disciplines and philosophical perspectives have given multi-dimensional answers, negation of negation and philosophical

propositions about whether there is ultimate law in natural science. The following is a comprehensive analysis from three aspects: philosophy of science, subject cases and technical verification: First, the dynamic development of scientific theory. The temporary and cumulative nature of scientific theory is always in the process of dynamic revision, such as Boyle's law from "absolute truth" to the discovery that it is only applicable to low temperature and low pressure conditions. Kuhn's paradigm revolution theory points out that scientific progress is not nonlinear accumulation, but qualitative change is achieved through the change of old and new paradigms, such as the transcendence of relativity over Newtonian mechanics. The fact that the four basic forces of modern physics have not been unified also confirms this point. Breakthrough of technical verification on theoretical boundary The breakthrough of drilling technology of bedrock under Antarctic ice reveals the limitation of geological model that needs physical verification. Similarly, the observation of micro-world by quantum mechanics constantly subverts classical physical cognition. The scope of human cognition of the universe has expanded from the solar system to the field of dark matter, and every observation technology innovation brings about the reconstruction of the theoretical framework. Second, the concrete manifestation of the relativity and absoluteness of truth dialectical relativity in the discipline Physics: Einstein's field equation is effective in the macro universe, but it can't explain the quantum scale phenomenon. Life science: the law of DNA base pairing (A-T, G-C) reflects the complementarity of Yin and Yang, but there are still a lot of unsolved mysteries about the gene expression mechanism. Brain science: Computer can simulate logical reasoning, but it cannot reproduce the neural mechanism of human emotional decision-making. The absolute historical characteristics of Newtonian mechanics still have practical validity in the low-speed macro field, and the successful prediction of

gravitational waves by general relativity verifies the local truth of its view of time and space. This kind of "finite absoluteness" forms the basis of technical application. For example, GPS system must consider both special relativity and general relativity correction. Third, the cognitive differences in the perspective of civilization The differences in the philosophical roots between the East and the West tend to lead to the pursuit of "ultimate truth" (for example, string theory tries to construct The Theory of Everything). This difference is reflected in contemporary scientific exploration: there are both attempts to construct universal equations of the universe and the path of "agnosticism" to accept cognitive limitations. The Cognitive Breakthrough Direction in Frontier Field Quantum Gravity Theory: Reconciling the Space Curvature/Quantum Fluctuation Contradiction between General Relativity and Quantum Mechanics Study on the Origin of Life: Paradigm Transformation from Chemical Evolution Theory to Self-organizing System Theory Dark matter Detection: The existing material theory can only explain 5% of the composition of the universe. Fourth, methodology enlightens iterative cognitive tools. It is equally important to establish an absolute space-time coordinate system (such as dating Antarctic ice cores) and develop new observation instruments (such as james webb telescope). Interdisciplinary integration trend The intersection of artificial intelligence and brain science produces brain like computing, and the theory of Oriental Yin and Yang inspires modern quantum theory research, showing the value of methodological integration. With regard to the dynamic revision of scientific theories, the following are illustrated by typical cases in many disciplines, showing how scientific theories are constantly iterated and perfected in practice: 1. The revision of Newtonian mechanics by general relativity in the field of physics is absolutely effective in the low-speed macro field, but it cannot explain the strong gravitational field and high-speed

motion phenomenon. Einstein introduced the space-time bending theory and put forward the general theory of relativity, which successfully predicted the precession phenomenon of Mercury perihelion (the deviation of 43 angular seconds every hundred years) and corrected the error of the classical mechanical model. The error correction of GPS satellite positioning system (special relativity time expansion and general relativity gravitational field effect should be considered at the same time) proves the engineering value of this correction. Quantum mechanics breaks through the paradigm of classical physics. Bohm's quantum potential theory transforms Schrodinger equation into the form of classical equation+Planck constant correction term, trying to reconcile the contradiction between quantum phenomenon and classical physics. Although this theory has not been fully accepted by the mainstream, it has inspired the subsequent development of quantum field theory. Similarly, the attempt to modify the standard model by string theory also reflects the multi-path exploration of physical theory. 2. Dynamic adjustment of frozen soil engineering model in the field of earth science During the construction of Qinghai-Tibet railway, scientists found that traditional frozen soil theory could not explain subgrade deformation in high temperature frozen soil area. Scientists put forward the theory of "active cooling subgrade", which forms a natural "thermal semiconductor" through air convection in the gravel layer, dynamically modifies the original passive thermal insulation model, and solves the problem of track hot melt settlement. This case shows the synergy between theoretical revision and technological innovation. By dynamically modifying the inversion parameters, the accurate prediction of the rock structure of the main hole of continental scientific drilling is realized, and the limitations of the early linear inversion method are corrected. Iii. Prediction model of submarine target impact burial in the field of engineering technology Aiming at the error of

static parameter model in the process of dynamic impact, scientists put forward a dynamic correction method of cohesion modulus and friction angle modulus. The trust region gradient algorithm is used to adjust the model parameters in real time, which improves the prediction accuracy of buried depth of small targets on the seabed by more than 40%. Application of Rough Set Theory in Fault Diagnosis Traditional fault diagnosis rules are easy to fail when the samples increase. Based on the dynamic rule correction method of rough set theory, the accuracy of fault diagnosis of rolling bearing is improved from 72% to 89% through attribute reduction and incremental update of rules, which shows the self-correction ability of data-driven model. Fourth, methodological enlightenment: These cases jointly reflect the typical path of scientific theory revision: technical verification drive: observation/experimental technical progress forces theoretical revision (such as quantum mechanics subverting classical physical cognition). The boundary conditions are clear: Newtonian mechanics is still effective under limited conditions, and the revision occurs when the theoretical application scope expands. The iterative verification mechanisms such as chaotic theory correcting earthquake model, Yin-Yang theory inspiring quantum research, etc.: frozen soil model passed the 14-kilometer test section verification, seabed model relied on gradient algorithm to dynamically adjust parameters, and scientific theory was dynamic. Just as Einstein's field equation is effective at the macro level but fails at the quantum scale, this "finite absoluteness" is promoting a new round of theoretical innovation, which confirms the endless nature of scientific exploration. Whether there is absolute truth or ultimate theory in natural science needs to be comprehensively analyzed from three aspects: philosophy of science, discipline practice and cognitive boundary. 1. Correctability and relativity of scientific theory. falsifiability and dynamic development Popper put forward that the symbol of

scientific theory lies in falsifiability, not absolute correctness. For example, Newtonian mechanics is effective in the macro field of low speed, but it is modified by general relativity; Quantum mechanics also reveals the non-classical characteristics of the micro-world, indicating that the essence of scientific theory is the phased achievement of "limited application" Technical verification and boundary breakthrough Einstein's general theory of relativity successfully predicted gravitational waves, but its failure at the quantum scale shows that any theory has its scope of application. Similarly, the dark matter model (which only explains 5% of the matter in the universe) and the incompleteness of quantum gravity theory both reflect the limitations of human cognition. Second, the controversy and finiteness of absolute truth. Some scholars believe that some natural laws (such as causality and one-way time) are absolute. For example, the mathematical axiom of 1+1=2 or the attribute of three-dimensional space is often regarded as an unshakable truth. However, this "absoluteness" still depends on the self-consistency of human logic system, and mathematics itself may change due to the adjustment of axiomatic system. The "absoluteness" fragment in the relative truth, such as the effectiveness of Newtonian mechanics at macro low speed and the law of DNA base pairing, has been revised or supplemented, but it still has practical significance in a specific range. This kind of absoluteness essence is the phased agreement between cognitive tools and objective reality, not the eternal truth. Third, the rationality and dilemma of the ultimate theory exploration. The scientific value of the great unity theory. Pursuing the unity of basic forces (such as string theory and supersymmetry theory) is an effort to simplify complexity scientifically. Although it has not been successful, such attempts have promoted the development of mathematical tools (such as topology) and experimental technologies (such

as particle collider). The cognitive paradox of the ultimate theory is a logical contradiction: if a theory is declared as the "ultimate truth", it is necessary to assume that human cognition has completely exhausted the laws of the universe, which is contrary to the experience of the history of science. Practical dilemma: The Big Bang theory and black hole model rely on indirect evidence, which cannot be verified by direct experiments, and their "ultimate" is in doubt. Fourth, methodological enlightenment: the combination of open cognition and criticism may balance the radicalism and conservatism of scientific exploration. Shi Yigong, a scientist's rational attitude, pointed out that the essence of science is "continuous improvement of knowledge". For example, actively accepting negative experimental results and avoiding the trap of perfectionism reflect the consciousness of theoretical error. This attitude promotes the progress of science in the "hypothesis-verification-correction" cycle. Conclusion The concept of "absolute truth" in natural science needs to be carefully defined: local validity: the law established under certain conditions (such as the theory of relativity in the macro universe) can be regarded as phased absoluteness. Ultimate illusion: claiming to find eternal equations (such as the grand unified theory) is easy to fall into the fallacy of scientism because it ignores the historical and technical dependence of cognition. The value of science lies not in the pursuit of unattainable absolute truth, but in infinitely approaching a deeper explanation of nature through theoretical iteration that can be falsified. As Popper said, "Scientific knowledge is a hypothesis that has not been falsified". On the grand unified theory of physics (Gut) and The Theory of Everything (T.

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自然科学

赞同添加评论

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还没有评论，发表第一个评论吧